

Amendment to Claims

1-2 (canceled).

3 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein the first conductive layer in the opening shields the substrate from an electromagnetic field created by an AC signal carried by the second conductive layer in the opening during circuit operation.

4 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

the method further comprising, before forming the first conductive layer, forming a primary insulating layer in the opening to insulate the first conductive layer from the substrate in the opening.

5 (currently amended). The method of Claim ~~[[1]]~~ 3 wherein the first conductive layer comprises a doped region of the semiconductor substrate occupying at least a portion of the sidewalls of the opening.

6 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein:

the semiconductor substrate is processed to provide an integrated circuit; and

an exposed portion of the second conductive layer serves as a contact pad of the integrated circuit.

7 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein:

the semiconductor substrate is processed to provide an integrated circuit; and

an exposed portion of the second conductive layer serves as an input, output, or input/output terminal of the integrated circuit.

8 (currently amended). The method of Claim ~~[[1]]~~ 4 wherein:

removing material along the second side of the substrate comprises mechanical removal of the material; and

the second conductive layer is exposed in the opening from the second side of the substrate during the mechanical removal of the material.

9 (previously presented). The method of Claim 8 wherein the mechanical removal of the material comprises chemical mechanical polishing.

10 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein:

the conductive layers include a third conductive layer overlaying the second conductive layer so as to substantially fill remaining space of the opening;

removing material along the second side of the substrate comprises mechanical removal of the material; and

the third conductive layer is exposed in the opening from the second side of the substrate during the mechanical removal of the material.

11 (previously presented). The method of Claim 10 wherein:

the mechanical removal of the material is followed by etching the substrate along its second side; and

at least one of the second and third conductive layers protrudes from the opening along the second side of the substrate after the etch.

12 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein:

after removing material along the second side of the substrate, the first and second conductive layers are exposed in the opening from the second side of the substrate; and

the method further comprises, after removing material along the second side of the substrate, processing the second side of the substrate with chemical reagent that reacts with at least one of the semiconductor substrate, the first conductive layer, and the second conductive layer to form an insulator.

13-19 (canceled).

20 (previously presented). A circuit manufacturing method comprising:

forming an opening in a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate;

forming at least three conductive layers overlaying one another in the opening such that each consecutive pair of the conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening; and

removing material along the second side of the substrate to reach the opening and expose at least one of the conductive layers from the second side of the substrate.

21 (previously presented). The method of Claim 20 wherein all of the conductive layers are metal layers separated from one another by insulating material in the opening.

22 (previously presented). The method of Claim 20 wherein at least two of the conductive layers are connected through a permanent or programmable connection outside the opening.

23-29 (canceled).

30 (currently amended). The method of Claim [[1]] 6 wherein the first conductive layer substantially laterally surrounds the second conductive layer in the opening.

31 (currently amended). The method of Claim [[1]] 6 wherein removing material along the second side of the substrate comprises (a) removing material of the substrate from its second side and (b) removing material of the first conductive layer exposed from the second side of the substrate.

32 (currently amended). The method of Claim [[1]] 7 wherein removing material along the second side of the substrate comprises (a) removing material of the substrate from its second side and (b) removing material, including material of the first conductive layer, situated in the opening, underlaying the second conductive layer, and exposed from the second side of the substrate so as to expose the second conductive layer from the second side of the substrate.

33 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i)

are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes out of the opening away from the second side of the substrate.

34 (previously presented). The method of Claim 33 wherein removing material along the second side of the substrate is performed such that the first conductive layer protrudes out of the opening away from the second side of the substrate.

35 (previously presented). The method of Claim 34 wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes further out of the opening away from the second side of the substrate than does the first conductive layer.

36 (withdrawn). The method of Claim 33 wherein removing material along the second side of the substrate is performed such that the first conductive layer is recessed into the substrate along its second side.

37-38 (canceled).

39 (currently amended). The method of Claim [[1]] 4 wherein providing the structure is performed such that, subsequent to removing material along the second side of the substrate, the opening is wider along the first side of the substrate than along its second side.

40 (currently amended). The method of Claim [[2]] 7 wherein:

the first and second conductive layers are separated by an insulating layer in the opening;

the first conductive layer substantially laterally surrounds the insulating layer in the opening; and

the insulating layer substantially laterally surrounds the second conductive layer in the opening.

41 (currently amended). The method of Claim [[2]] 6 wherein:

the first and second conductive layers are separated by an insulating layer in the opening; and

removing material along the second side of the substrate comprises (a) removing material of the substrate from its second side, (b) removing material of the insulating layer exposed from the second side of the substrate, and (c) removing material of the first conductive layer exposed from the second side of the substrate.

42 (currently amended). ~~The method of Claim 2~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein the first and second conductive layers are separated by an insulating layer in the opening;

wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes out of the opening away from the second side of the substrate.

43 (previously presented). The method of Claim 42 wherein removing material along the second side of the substrate is performed such that the first conductive layer protrudes out of the opening away from the second side of the substrate.

44 (previously presented). The method of Claim 43 wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes further out of the opening away from the second side of the substrate than does the first conductive layer.

45 (previously presented). The method of Claim 43 wherein removing material along the second side of the substrate is performed such that the insulating layer protrudes out of the opening away from the second side of the substrate.

46 (previously presented). The method of Claim 45 wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes further out of the opening away from the second side of the substrate than does the insulating layer.

47 (previously presented). The method of Claim 46 wherein removing material along the second side of the substrate is performed such that the insulating layer protrudes further out of the opening away from the second side of the substrate than does the first conductive layer.

48 (withdrawn). The method of Claim 42 wherein removing material along the second side of the substrate is performed such that the first conductive layer is recessed into the substrate along its second side.

49 (withdrawn). The method of Claim 48 wherein removing material along the second side of the substrate is performed such that the insulating layer protrudes out of the opening away from the second side of the substrate.

50 (withdrawn). The method of Claim 49 wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes further out of the opening away from the second side of the substrate than does the insulating layer.

51 (canceled).

52 (currently amended). The method of Claim [[2]] 6 wherein providing the structure is performed such that, subsequent to removing material along the second side of the substrate, the opening is wider along the first side of the substrate than along its second side.

53 (currently amended). The method of Claim 3 wherein the first and second conductive layers are separated by an insulating layer in the opening.

~~2 wherein the first conductive layer in the opening shields the substrate from an electromagnetic field created by an AC signal carried by the second conductive layer in the opening during circuit operation.~~

54 (previously presented). The method of Claim 4 wherein the first and second conductive layers are separated by a further insulating layer in the opening.

55 (previously presented). The method of Claim 54 wherein removing material along the second side of the substrate comprises (a) removing material of the substrate from its second side, (b) removing material of the further insulating layer exposed from the second side of the substrate, and (c) removing material of the first conductive layer exposed from the second side of the substrate.

56 (previously presented). The method of Claim 55 wherein removing material along the second side of the substrate further comprises removing material of the primary insulating layer exposed from the second side of the substrate.

57 (previously presented). The method of Claim 55 wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes out of the opening away from the second side of the substrate.

58 (previously presented). The method of Claim 57 wherein removing material along the second side of the substrate is performed such that the first conductive layer protrudes out of the opening away from the second side of the substrate.

59 (previously presented). The method of Claim 58 wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes further out of the opening away from the second side of the substrate than does the first conductive layer.

60 (currently amended). The method of Claim ~~[[1]]~~ 4 wherein removing material along the second side of the substrate comprises (a) removing material of the substrate from its second side and (b) removing material of the first conductive layer exposed from the second side of the substrate so as to expose the second conductive layer from the second side of the substrate.

61 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein the first and second conductive layers form a P-N junction in the opening.

62 (currently amended). ~~The method of Claim 1~~

A circuit manufacturing method comprising:

providing a structure in which an opening extends into a first side of a semiconductor substrate having a second side opposite the first side such that the opening penetrates partway through the substrate, a plurality of conductive layers overlay one another in the opening, and the conductive layers include a first conductive layer and a second conductive layer overlaying the first conductive layer such that the first and second conductive layers (i) are separated by insulating material in the opening, or (ii) form a P-N junction in the opening, or (iii) form a Schottky junction in the opening;

removing material along the second side of the substrate to reach the opening and expose the second conductive layer from the second side of the substrate;

wherein the first and second conductive layers form a Schottky junction in the opening.

63 (previously presented). The method of Claim 20 wherein removing material along the second side of the substrate comprises removing material of the substrate from its second side.

64 (previously presented). The method of Claim 63 wherein removing material along the second side of the substrate further comprises removing material of at least one of the conductive layers exposed from the second side of the substrate.

65 (previously presented). The method of Claim 63 wherein removing material along the second side of the substrate further comprises removing material of two of the conductive layers exposed from the second side of the substrate.

66 (previously presented). The method of Claim 20 wherein removing material along the second side of the substrate is performed such that at least one of the conductive layers protrudes out of the opening away from the second side of the substrate.

67 (previously presented). The method of Claim 20 wherein removing material along the second side of the substrate is performed such that each conductive layer protrudes out of the opening away from the second side of the substrate.

68 (previously presented). The method of Claim 20 wherein:

the conductive layers comprise (a) a first conductive layer, (b) a second conductive layer overlaying the first conductive layer, and (c) a third conductive layer overlaying the second conductive layer; and

removing material along the second side of the substrate is performed such that the third conductive layer is exposed from the second side of the substrate.

69 (previously presented). The method of Claim 68 wherein removing material along the second side of the substrate comprises (a) removing material of the substrate from its second side and (b) removing material, including material of at least one of the first and second conductive layers, situated in the opening, underlaying the third conductive layer, and exposed from the second side of the substrate so as to expose the third conductive layer from the second side of the substrate.

70 (previously presented). The method of Claim 68 wherein removing material along the second side of the substrate comprises (a) removing material of the substrate from its second side and (b) removing material, including material of both of the first and second conductive layers, situated in the opening, underlaying the third conductive layer, and exposed from the second side of the substrate so as to expose the third conductive layer from the second side of the substrate.

71 (withdrawn). The method of Claim 68 wherein removing material along the second side of the substrate is performed such that the third conductive layer protrudes out of the opening away from the second side of the substrate.

72 (withdrawn). The method of Claim 71 wherein removing material along the second side of the substrate is performed such that the first and second conductive layers protrude out of the opening away from the second side of the substrate.

73 (withdrawn). The method of Claim 72 wherein removing material along the second side of the substrate is performed such that the third conductive layer protrudes further out of the opening away from the second side of the substrate than do the first and second conductive layers.

74 (withdrawn). The method of Claim 73 wherein removing material along the second side of the substrate is performed such that the second conductive layer protrudes further out of the opening away from the second side of the substrate than does the first conductive layer.

75 (previously presented). The method of Claim 20 wherein:

the conductive layers comprise (a) a first conductive layer, (b) a second conductive layer overlaying the first conductive layer, and (c) a third conductive layer overlaying the second conductive layer;

a first insulating layer separates the first and second conductive layers;

a second insulating layer separates the second and third conductive layers; and

removing material along the second side of the substrate is performed such that the third conductive layer is exposed from the second side of the substrate.

76 (previously presented). The method of Claim 75 wherein removing material along the second side of the substrate comprises (a) removing material of the substrate from its second side, (b) removing material of the first and second conductive layers exposed from the second side of the substrate, and (c) removing material of the first and second insulating layers exposed from the second side of the substrate.

77 (previously presented). The method of Claim 75 wherein removing material along the second side of the substrate is performed such that the third conductive layer protrudes out of the opening away from the second side of the substrate.

78 (previously presented). The method of Claim 77 wherein removing material along the second side of the substrate is performed such that the first and second conductive layers protrude out of the opening away from the second side of the substrate.

79 (previously presented). The method of Claim 78 wherein removing material along the second side of the substrate is performed such that the third conductive layer protrudes further out of the opening away from the second side of the substrate than do the first and second conductive layers.

80 (previously presented). The method of Claim 20 wherein forming the opening is performed such that, subsequent to removing material along the second side of the substrate, the opening is wider along the first side of the substrate than along its second side.

81 (new). The method of Claim 3 wherein the first conductive layer is a metal layer.

82 (new). The method of Claim 6 wherein the first and second conductive layers are metal layers.

83 (new). The method of Claim 4 wherein:

the semiconductor substrate is processed to provide an integrated circuit; and

an exposed portion of the second conductive layer serves as a contact pad of the integrated circuit.